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A STUDY OF THE OPERATION OF A JONES P40 WET HIGH INTENSITY MAGNETIC SEPARATOR

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MICROMEDIA

A STUDY OF THE OPERATION OF A JONES P40 WET HIGH INTENSITY MAGNETIC SEPARATOR

by

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SUMMARY

The operation of a Jones wet high intensity magnetic separator, model P40, was studied using a barite sample from Brookfield, Nova Scotia as feed. A barite concentrate of 99.84 wt % purity and representing 79.5% of the feed weight was produced. The overall recovery of $BaSO_4$ was 83%.

Keywords: High intensity, magnetic separator, wet process, operating characteristics, barite, concentrate, siderite

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ÉTUDE SUR LE FONCTIONNEMENT D'UN SÉPARATEUR MAGNÉTIQUE PAR VOIE HUMIDE JONES P40 À HAUTE INTENSITÉ

par

S.S.B. Wang*

RÉSUMÉ

Utilisant un échantillon de barytine provenant de Brookfield en Nouvelle-Écosse, on a étudié le fonctionnement d'un séparateur magnétique par voie humide Jones à haute intensité, de type P40. Un concentré de barytine, d'une pureté atteignant 99,84 % du poids et représentant 79,5 % du poids de l'échantillon initial, a été produit. La récupération totale du $BaSO_4$ a été de 83 %.

Mots-clés: Haute intensité, séparateur magnétique, procédé par voie humide, caractéristiques de fonctionnement, barytine, concentré, sidérite.

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INTRODUCTION

The Jones wet high intensity magnetic separator is capable of separating feebly magnetic minerals from non-magnetic minerals by a wet process, even at very fine particle sizes. A laboratory-size unit Jones P40 was purchased to beneficiate, by removal of magnetic impurities, non-metallic minerals such as glass sand, clay, talc, barite, etc. In this investigation, a high grade barite sample from Brookfield, Nova Scotia, containing up to 15 per cent siderite (Fe_2CO_3) was processed to both determine the operating characteristics of the Jones as well as to upgrade the ore by removal of the iron minerals.

DESCRIPTION OF UNIT

The Jones unit is shown in Fig. 1[1]. Figure 2 is a schematic description. Magnet yokes (2) with magnetic coils on them are enclosed in air-cooled casings. One or two rotor discs (6), depending on the type of unit, are set on a rotor shaft (4). For the Jones P40, there is only one rotor disc. The drive (5) is located directly on the rotor shaft. The feed pulp is prepared in a mixing tank and pumped to the feed pipes (8). It then flows through the pipes and into the plate boxes (7). The feed points are at the leading edges of the magnetic fields. Feeding is continuous by the rotation of the plate boxes on the rotor. Each rotor has two symmetrically located feed points. In this particular test, only one feed point was used. The arrangement of the grooved plates in the plate box is shown in Fig. 3. The gap width between the plates is determined by the type of the plates and the size of spacer pins. In this test, (12 grooves/in) plates and spacer pins of 1.5 mm diam were used setting the gap width to be 0.3 mm, and there were three gaps per box. Within the plate box, the magnetic flux concentrates at the ridge-tips of the grooved plates. The magnetic particles in the feed pulp adhere to the plates whereas the remaining non-magnetic pulp passes through the plate box and is collected in a launder (11) underneath. Before leaving the magnetic field, any entrained non-magnetic particles are washed out by low-pressure washing water (13).

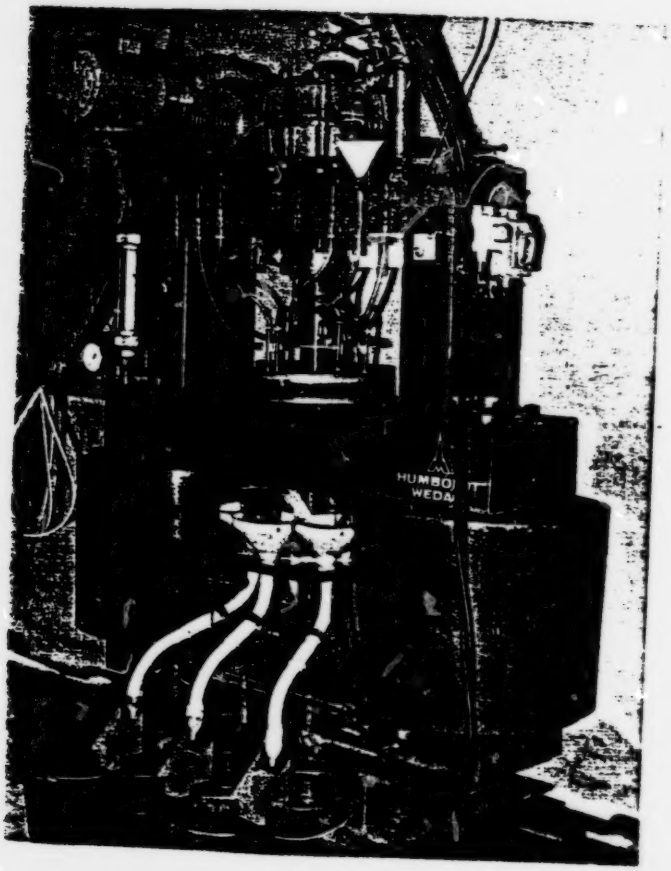
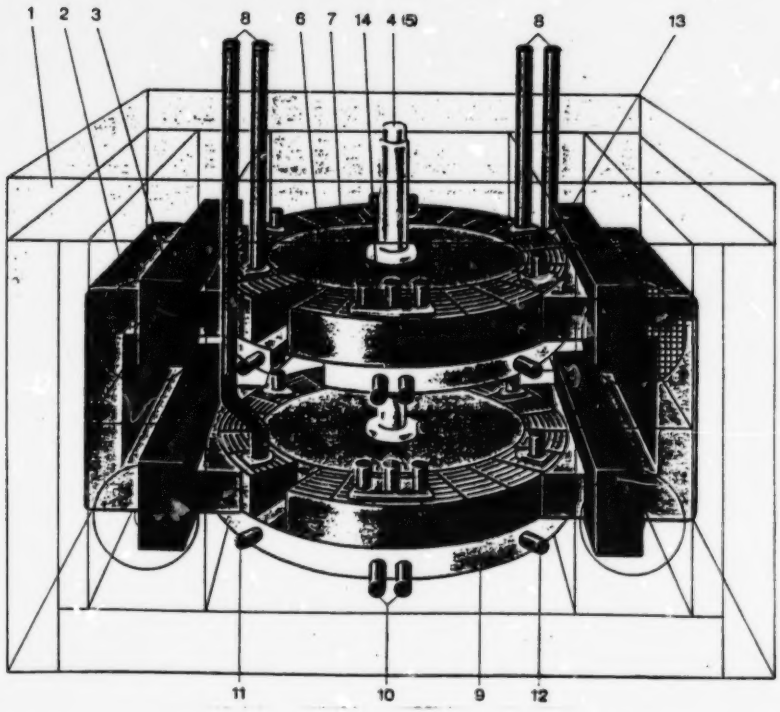


Fig. 1 - The Jones P40 Unit



1 Frame
2 Magnet yokes
3 Magnetic coils
4 Rotor shaft
5 Drive
6 Rotor disc
7 Plate boxes
8 Feed pipes
9 Collecting launders
10 Product discharge magnetics
11 Product discharge non-magnetics
12 Product discharge middlings
13 Washing device
14 Scouring device

Fig. 2 - The schematic description of a Jones wet magnetic separator

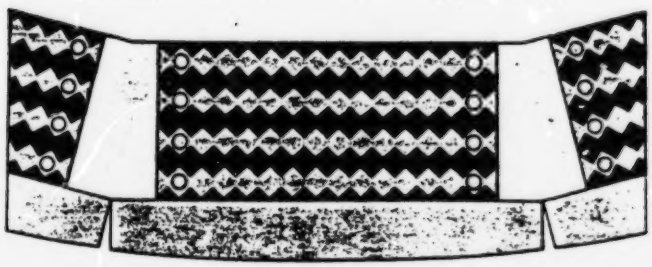


Fig. 3 - Grooved plates arrangement

Such washings form the middling product which is collected in a separate launder (12). When the plate boxes reach the demagnetized zone, i.e. a zone approximately midway between the two magnetic poles, the adhering magnetic particles are washed out with scouring water sprays (14).

EXPERIMENT

SAMPLE

A 7.6 kg sample of Brookfield barite was prepared by jaw crushing and ground to minus 0.21 mm (65 mesh) in a swing sledge mill. Siderite is the main impurity which is magnetic and has a S.G. of 3.9; pure barite has a S.G. of about 4.5.

PROCEDURE

1. Mix the solid sample (7.6 kg) with water (18 L) in the mixing tank (30% solid).
2. Switch on the rotor drive and the power supply to the magnetic coil and adjust the electric current (power) to the desired value (5 amp).
3. Open the water valve for washing and scouring while regulating the water flow (by flowmeter) to about 7.6 L/min (the indicator in the flowmeter positioned at 40% of maximum flow).
4. Open the valve at the bottom of the mixing tank and start the feed pump, the pump speed being set at 1.7 L/min (position 4.5 on the pump speed setting dial).
5. Let the unit run for a couple of minutes to stabilize conditions.
6. Adjust product splitter plates on the collecting funnels to allow product samples to flow into respective sample collecting buckets. Record sample collecting time.
7. At the end of sample collecting, close the valve at the bottom of the mixing tank and stop the feed pump.

8. Switch off the power supply to the magnetic coils.
9. Drain the remaining feed pulp from the mixing tank and fill the tank with water.
10. Run the Jones for approximately 3 min with water to thoroughly clean the system.
11. Close the main water valve for washing and scouring and switch off rotor drive.
12. Filter and dry the collected product samples.
13. Measure densities of the dried samples by pycnometer and determine $BaSO_4$ content by chemical analysis.

RESULTS

The test results are presented in Table 1. The results indicate that

Table 1 - Test results

Sample	wt %	Density g/cm³	$BaSO_4$ content wt %
Head	-	4.39	95.12
Non-magnetic	79.5	4.48	99.84
Middling	5.9	4.38	86.73
Magnetic	14.6	3.91	21.91

an excellent separation of barite was obtained. The concentrate (non-magnetic product) has a $BaSO_4$ purity of 99.84% and represents 79.5 wt % of the feed. The recovery of $BaSO_4$ is 83%. Tests with Brookfield barite on an Eriez magnetic roll separator[2], for different size fractions, gave barite concentrates of purity from 93.32 to 98.72 wt % with 68.3 to 83.8 wt % of the feed.

More tests should be carried out to fully evaluate the Jones P40 magnetic separator using different materials and different experimental conditions, such as variance of magnetic field strength and gap width.

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